

# Course Lecture Schedule

## Lecture 1. General Chemistry Review

Lewis Structures, Molecular Geometry, Arrhenius Equation, Second Law

Text: Lewis Structures; Molecular Geometry; Chemical Kinetics; Acids & Bases, Chemical Thermodynamics

Handout: [Lewis Structure Methodology](#)

Wiki: [Hybridization](#); [Aromaticity](#); [Arrhenius Equation](#); [Second Law of Thermodynamics](#)

## Lecture 2. Intermolecular Forces (Noncovalent Interactions)

Coulomb's Law, Electronegativity, Hydrogen Bonds, Van der Waals Forces, Dipole-Dipole & Ion-Dipole Interactions, Solvation, Hydrophobicity

Wiki: : [Electronegativity](#); [Intermolecular Forces](#); [London Dispersion Forces](#); [Hydrogen Bonds](#); [Coulomb's Law](#); [Solvation](#); [Hydrophobicity](#)

Text: Electronegativity, Intermolecular Forces (Hydrogen Bonding, Van Der Waals Forces, Dipole-Dipole & Ion-Dipole Interactions)

## Lecture 3. Solubility and Lipids

Thermodynamics of Liquid-Liquid Solubility, Octanol-Water Distribution Equilibrium Constants [Partition Coefficients (P)], Phospholipid Components and Structure, Cell Membrane Structure and Properties

Wiki: [Partition Coefficient](#);

Link: [UCSF Membrane Tutorial](#) (Great resource!!)

Reading: The Components and Properties of Cell Membranes

Link: [Kimball's Biology Pages: Fats](#) (Unsaturated Fats, Trans and Omega Fatty Acids, [Phospholipids](#))

## Lecture 4. Condensation and Hydrolysis Reactions

Alcohols and Carboxylic Acids, Triglyceride Formation, Polyphosphate and Phospholipid Formation

Handout: Condensation Reactions

## Lecture 5. Amino Acids

Structure, Chirality, Side Chain Polarity, Peptide Bond, Peptide Condensation and Hydrolysis, Henderson-Hasselbalch Equation, Charge and pH, Solubility and pH

Wiki: [Amino Acids](#); [Chirality](#); [Peptide Bond](#); [Henderson-Hasselbalch Equation](#);

Link: [Amino Acid Structures at pH=7.4](#) [Amino Acid Chart with pKa Table](#)

## Lecture 6. Protein Structure

Primary Structure, Disulfide Bonds, Secondary Structure - Alpha Helices and Beta Sheets, Tertiary/Quaternary Structures and Associated Noncovalent Interactions, Prions, PostTranslational Protein Modifications

Wiki: [Protein Structure](#) [Disulfide Bonds](#)

Kimball's Biology Pages: [Proteins](#); [Polypeptides](#);

Kimball's Biology Pages: Protein Structure: [Primary](#); [Secondary](#); [Tertiary](#); [Quaternary](#)

## Lecture 7. Chemical Kinetics

McQuarrie Text Chapters 17 and 18

## Lecture 8. Enzymes: Structure and Function

Enzyme Catalysis, Mechanism of Action, Active Site, Substrate Binding, Catalytic Roles, Michaelis-Menton Kinetics, Lineweaver-Burk Plots, Km and Vmax Determination, Turnover Numbers, Km and Substrate-Enzyme Affinity

Text: Michaelis-Menten Model of Enzyme-Catalyzed Reactions

Kimball's Biology Pages: [Enzymes](#)

Kimball's Biology Pages: [Enzyme Kinetics](#)

## Lecture 9. Enzymes as Drug Targets

[PS7 Due](#)

Active Site Inhibitors, Allosteric Inhibition, Competitive / Non-Competitive Inhibitors, Suicidal Substrates

Wiki: [Enzymes](#); [Enzyme Inhibitors](#)

L10 R 2/8

### Lecture 10. Medical Approaches to Inflammation I

Cyclooxygenase Case Study

Quiz 5

Reading: Protein Function – Section III Cyclooxygenase (COX): An Example of How Enzymes Function

Wiki: [NSAIDs](#); [COX-2 Inhibitors](#)

Reading: Molecular Basis of Inflammation

L11 T 2/13

[PS-8](#)

### Lecture 11. Medical Approaches to Inflammation II

Steroids - Structure, Intracellular Receptors, Anti-Inflammatory MOA

Reading: Molecular Basis of Inflammation

Reading: Protein Function – Section II Nuclear Receptors: An Example of How Proteins Function

Reading: Kimball's Biology Pages: [Steroid Hormone Receptors and their Response Elements](#)

Wiki: [Steroid](#) ; [Zinc Finger](#); [Complex Ion](#) ; [d-Orbitals](#)

L12 R 2/15

Quiz 6

### Lecture 12. Receptors as Drug Targets I

Neurotransmitters & Hormones, Agonists, Antagonists, Partial Agonists, Inverse Agonists,  
Treatment of Hormone-Dependent Breast Cancers

Wiki: [Neurotransmitters](#); [Hormones](#); [Receptors](#); [Antagonists](#); [Agonists](#); [Partial Agonists](#); [Inverse Agonists](#);  
[Ligands](#); [Tamoxifen](#); [Aromatase Inhibitors](#);

L13 T 2/20

### Lecture 13. Receptors as Drug Targets II

Desensitization & Sensitization; Tolerance & Dependence; Receptor Types & Subtypes; Affinity, Efficacy, & Potency; Ligand-Receptor Dissociation Equilibria, EC50, IC 50

Wiki: [Efficacy](#); [Dose-Response Curve](#); [EC50](#); [IC50](#); [Therapeutic Index](#);

Scribd: [Sensitization and Desensitization](#);

T1 R 2/22

Midterm

### Mid-Term Examination on Material from Lectures 1-13

[A Few Practice Problems....](#)

L14 T 2/27

### Lecture 14. Nucleic Acids as Drug Targets

Structure of DNA, Central Dogma, Intercalating Drugs, Alkylating & Metallating Agents, Cisplatin, 5-FU

Wiki: [Alkylating Agents](#); [Sulfur Mustard](#); [Cisplatin](#);

L15 R 3/1

### Lecture 15. Receptor Structure and Signal Transduction I – Overview of Ion Channel Receptors

Ion Concentration Gradients, Ion Channel Structure and Mechanisms of Action, Ligand-Gated and Voltage-Gated Ion Channels, Cell Membrane Potentials, Nernst Equation and Membrane Equilibrium Potentials, Ion Movements and Resulting Inhibitory/Excitatory Potential Changes,

Wiki: [Ion Channels](#); [Nernst Equation](#); [Action Potential](#) ; [K+ Ion Channel Nobel Chemistry Lecture \(Video\)](#)

UCSF Reading: "Diffusion and Transport Across Membranes" Section on Ion Channels (pages 80-86)

L16 R 3/6

[PS9 Due](#)

### Lecture 16. Receptor Structure and Signal Transduction II – Thermodynamics of Ion Channels

Sodium-Potassium-ATP Pump Mechanism, Cell Membrane Potentials, Nernst Equation and

Membrane Equilibrium Potentials, Free Energy Changes of Ion Movement across Voltage and Concentration

Gradients, Ion Movements and Resulting Inhibitory/Excitatory Potential Changes

UCSF Reading: "Diffusion and Transport Across Membranes" Section on ATP-Driven Ion Pumps (pages 73-77)

Wiki: [Neuron](#); [Membrane Potential](#); [Na+/K+-ATPase](#)

McGraw-Hill: [Sodium-Potassium-ATP Pump](#)

**Lecture 17. Receptor Structure and Signal Transduction III – G-Protein Coupled Receptors (GPCRs)**

G-Protein Coupled Receptor Structure, Evolutionary Tree of GPCRs, GPCR Signaling Mechanism of Action

[2012 Nobel Chemistry - Nobel Lecture Rob Lefkowitz](#) [Nobel Lecture Brian Kobilka](#)

Wiki: [G-Protein Coupled Receptors \(GPCRs\)](#);

L17 T 3/8

**Lecture 18. Cholinergics**

Nervous System, Cholinergic System, Acetylcholine Structure & Receptor Binding, Cholinergic Antagonists, Acetylcholinesterase Inhibitors

Quiz 7

L18 R 3/20

**Lecture 19. Adrenergics**

Geometry of Adrenergic Receptors, Main Types of Norepinephrine Receptors, Interaction of Adrenergic Receptors with Neurotransmitters, MOA of Activated Receptors

L19 T 3/22

**Lecture 20. Psychoactive Drugs I: Stimulants and Tranquilizers**

Handout:

L20 R 3/27

**Lecture 21. Psychoactive Drugs II: Anti-Depressants**

Handout:

L21 T 3/29

**Compensatory Time for [Review Paper](#) Preparation**

C1 R 4/3

**Lecture 22. Psychoactive Drugs III: Anti-Psychotics and Hallucinogens**

Handout

L22 T 4/5

**Lecture 23. Psychoactive Drugs IV: Cannabinoids, Opium & Opioid Analgesics**

Cannabinoids, Source and History of Opiates, Structure of Opioids and Opioid Receptors, Endogenous Opioids, Side Effects of Opiates

L23 R 4/10

Text Assignment: MedChem – Chapter 21

L24 T 4/12

**Lecture 24. Chemistry of Local & General Anesthetics**

MOA for Local Anesthetics, pKa Relevance, History of Cocaine Use by Humans, MOA for General Anesthetics, Molecular Structures of Widely Used General Anesthetics

Handout: Local and General Anesthetics

T2 T 4/17

**[Test 2 Concepts](#)**

R1 R 4/19

**Review**

[Paper Due](#)